

# BOTANICAL GAZETTE.

VOL. XII.

CRAWFORDSVILLE, IND., JANUARY, 1887.

No. 1.

## A Revision of the North American Species of Fissidens.\*—I.

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After examining critically the North American species of Fissidentæ, I conclude that the group as elaborated in the Manual of Mosses of North America, by Lesquereux and James, includes too many nominal species, and that it would be better to combine some forms which have been separated as poorly defined species. In this revision I attempt to make the distinctions between species more nearly equivalent to those which the best systematists demand between species of phanerogams. The descriptions of the Manual are necessarily condensed and are not clearly diagnostic. I therefore present complete descriptions so far as material at hand permits, and embody the most obvious diagnostic characters in a synoptical key. I also offer some critical remarks upon difficult, doubtful or excluded species.

For the synonymy of all species occurring in Great Britain, I refer to Braithwaite's British Moss-Flora, and supply only references to American works and collections. In species not British full synonymy is given.

In description I have substituted *leaf-cells* for the unmeaning term "areolation," and *rhizoids* for "radicles." I use the terms *vaginant lamina*, *vertical lamina* and *inferior lamina* to designate respectively the sheathing or conduplicate portion of the leaf, the whole of the vertical blade, and the part of it below the costa.

Whenever possible, I include in the descriptions measurements of the leaf-cells of the vertical lamina and of the spores, instead of the indefinite expressions "large" or "small." Measurements of height are in all cases exclusive of the fruit.

\* Read before the A. A. A. S., Buffalo meeting, August, 1886.

**FISSIDENS** HEDWIG.

*Fissidens* HEDWIG: Fund. Musc. 2. 91. — SULLIVANT: Mosses of U. S. 24. — LESQ. & JAMES: Man. 81.

*Dicranum* AUCT.

*Skitophyllum* DE LA PYLAIE: Desv. Jour. Bot. 6. 133.

*Schistophyllum* LINDBERG.

*Octodiceras* BRIDEL: Sp. Musc. 1. 162.

*Conomitrium* MONTAGNE: Ann. Sci. Nat. II. 8. 245.—SULLIVANT: Mosses of U. S. 25.—LESQ. & JAMES: Man. 89.

Plants large or small, simple or branched, gregarious or cespitose, terrestrial or aquatic: leaves distichous, conduplicate below, often equitant and clasping, the back produced into a prominent vertical wing with a sub-percurrent or excurrent costa; cells parenchymatous, all chlorophyllose: flowers monoicous, pseudo-dioicous or dioicous: fruit terminal or lateral; pedicel usually long; teeth sixteen, long, deeply bifid with the unequal divisions rough, or short and perforate; calyptra cucullate, mitrate or conic; operculum conic or rostrate.

HABITAT: On the ground, rocks or trees, or in water; in all parts of the world but chiefly tropical, not alpine.

A very large genus of over three hundred described species, represented in North America by twenty species, which may be characterized and arranged in a fairly natural order as follows:

§ 1. **Eufissidens** MÜLLER: Syn. Musc. 1. 50. — Plants terrestrial or submersed but not floating: leaves soft, of one layer of cells.

\* *Fruit terminal.*

+ *Monoicous, male flowers axillary.*

Leaf-cells small, densely chlorophyllose, in distinct rows 1. **limbatus.**

Leaf-cells larger, not densely chlorophyllose, nor in distinct rows. . . . . 2. **bryoides.**

+ + *Dioicous or monoicous with the male flowers terminal on a rooting branch at the base of the female stem.*

+ + *Leaf-cells 1½-2 times as long as wide, large, distinct.*

Plants less than 1 mm. high, leaves 2 or 3 pairs . . . . . 3. **Closteri.**

Plants 2-4 mm. high, wholly hyaline, leaves 3-5 pairs . . . . . 4. **hyalinus.**

+ + *Leaf-cells almost or quite isodiametric, often obscure.*

¶ *Leaves with a narrow border, at least on vaginant lamina.*

Marginal leaf-cells not papillose . . . . . 5. **incurvus.**

Marginal leaf-cells papillose.

Costa percurrent . . . . . 6. **Ravenelii.**

Costa ceasing below apex . . . . . 7. **Garberi.**

¶¶ *Leaves without a border.*

Acute, cells densely chlorophyllose, obscurely papillose . 8. **Donnellii.**

- Obtuse, cells pellucid, operculum conic . . . . . 9. **obtusifolius**.  
 Apiculate, operculum with acicular beak . . . . . 10. **osmundoides**.

¶¶¶ *Leaves with a thick reddish border.*

- Plants submersed, rigid . . . . . 11. **rufulus**.

\* \* *Fruit lateral.*

+ *Leaves without a border.*

- Obtuse, entire, plants 2-5 cm. high, fruit sub-terminal . 12. **polypodioides**.  
 Rounded at apex, irregularly serrate, 1-2 cm. high, fruit  
 sub-basal . . . . . 13. **sub-basilaris**.

- Mucronate, regularly serrulate, fruit basal or sub-basal . 14. **taxifolius**.

+ + *Leaves bordered by several rows of paler, often  
 incrassate, cells.*

- Capsule cernuous, leaf-cells minute . . . . . 15. **Floridanus**.

- Capsule erect or inclined, flowers dioicous, leaf-cells ob-  
 scure . . . . . 16. **decipiens**.

- Capsule erect or inclined, flowers monoicous, leaf-cells  
 distinct . . . . . 17. **adiantoides**.

‡ 2. **Pachyfissidens** MULLER: Syn. Musc. 1. 45.—Leaves rigid,  
 composed of more than one layer of cells, opaque.

- Plants growing in water or very wet places . . . . . 18. **grandifrons**.

‡ 3. **Octodiceras** BRIDEL: Sp. Musc. 1. 162.—Plants aquatic, fili-  
 form, floating.

- Plants large, much branched, pedicel shorter than the  
 capsule . . . . . 19. **Julianus**.

- Plants small, little branched, pedicel longer than the  
 capsule . . . . . 20. **Hallianus**.

1. **F. limbatus** SULLIVANT: Pac. R. R. Rept. 4. 185. t. 1.

LESQUEREUX: Trans. Am. Phil. Soc. 13. 3.—Mem. Cal. Acad. 1. 7.—BOLANDER: Cat. 37.—  
 WATSON: Bot. Calif. 2. 374.—LESQ. & JAMES: Man. 82.—MITTEN: Jour. Linn. Soc.  
 21. 556.

COLL.: SULL. & LESQ. Musci Bor. Am. 2 ed. 105.

Plants small, 2-5 mm., yellowish green or in wet places bright green,  
 gregarious: stem simple: leaves on sterile plants 8-12 pairs (on fertile  
 plants fewer), oblong lanceolate, apiculate or somewhat acuminate; bor-  
 der hyaline, widening from apex to base except on inferior lamina, very  
 wide at base of vaginant lamina; costa thick, sub-percurrent; cells small,  
 8-12×12 $\mu$ , arranged in rows, densely chlorophyllose, sub-quadrate, more  
 irregular in vaginant lamina, which is one-half to three fourths the length  
 of leaf: flowers monoicous; male gemmiform, axillary; female terminal:  
 fruit terminal; pedicel 6-10 mm. long, flexuous, yellowish-red; capsule  
 green, sub-oval, unsymmetric, cernuous; teeth red, inserted below the  
 mouth, much introflexed, deeply split; lid red, conic-rostrate, one-half  
 length of capsule; spores 12-16 $\mu$ , usually 14 $\mu$ .

HAB.: California; near San Francisco (*Bigelow, Bolander*); San Gabriel and Pasadena (*Allen*).

**2. *F. bryoides* HEDWIG:** *Musc. Frond.* 3. 67. t. 29.

BRAITHWAITE: *Br. Moss-Fl.* 1. 71. t. 10 E.—SULLIVANT: *Mosses U. S.* 24.—LESQ. & JAMES: *Man.* 81.—MITTEN: *Jour. Linn. Soc.* 21. 554.

COLL.: DRUMMOND: *Musci Am.* I. no. 113 in part.—SULLIVANT: *Musci All.* no. 185.—SULL. & LESQ.: *Musci Bor. Am.* 1 ed. no. 82.

Plants small, gregarious or somewhat cespitose: stems simple or fasciculate at the base, ascending: leaves 3-many pairs, rather remote, lanceolate or oblong lanceolate, abruptly apiculate; border thickish, pale, usually confluent with the excurrent costa; vaginant lamina one-half length with broader border, inferior lamina narrowed and decurrent; cells roundish-hexagonal, distinct,  $12-16 \times 16-20 \mu$ , in vaginant lamina  $14-20 \times 20-24 \mu$ : flowers monoicous; male numerous, axillary, gemmiform, pedicellate, antheridia few, small; female terminal, vaginant lamina of perigonal leaves broadly ovate, erose, that of the perichaetial leaves with a broad border: fruit terminal; seta red or purplish, 4-6 mm. long; capsule erect, oval or elliptical, brown; teeth cleft one-half length, divisions very scabrous; operculum conic rostrate, short, red; calyptra cucullate; spores  $20-26 \mu$ .

HAB.: On the ground: Canada (*Macoun*); New York (*Barron, Peck*); New Jersey (*Austin*); Columbus and Cincinnati, Ohio (*Sullivan*); Rocky Mts. (*Drummond*); Sierras (*Lemmon*).

**Var. *cæspitans* SCHIMPER:** *Syn. Musc.* 2 ed. 111.

BRAITHWAITE: *Br. Moss-Fl.* 1. 72.—LESQ. & JAMES: *Man.* 82.

*F. Curnovii* MITTEN: *Jour. Linn. Soc.* 21. 556.

Plants 2-3 cm. high, more robust than the species, loosely cespitose in broad soft tufts, pale green: stems branching sparsely by innovations, interwoven by rufous purple rhizoids: leaves with a prominent border ceasing at the minutely serrulate apiculus: capsule pale.

HAB.: Wet rocks, New River, White Mts., N. H. (*Prof. O. D. Allen*).

**3. *F. Closteri* AUSTIN:** *Bull. Torr. Bot. Club* 5. 21.

SULLIVANT: *Icon. Musc. Suppl.* 44. t. 29.—LESQ. & JAMES: *Man.* 81.—MITTEN: *Jour. Linn. Soc.* 21. 558.

COLL.: AUSTIN: *Musci App. Suppl.* no. 479.

Plants very minute and almost stemless, less than 1 mm. high, gregarious: leaves two or three pairs, the lower smaller, broad ovate, the upper two or three times longer; border none; vaginant lamina ovate, one-half length, apical lamina narrow; costa strong, ceasing below the apex; cells rectangular, more or less irregular at margin and near apex,  $8 \times 15-20 \mu$ , those of the vaginant lamina  $14-16 \times 20-40 \mu$ : flowers monoicous or pseudo dioicous; male gemmiform, attached to the female by rhizoids or separate, antheridium single: fruit terminal; capsule erect,

oblong, tapering gradually to the thick seta 1.5 mm. long; operculum conic-rostrate, the beak only covered by the conic calyptra; teeth when dry strongly reflexed around the flaring mouth; spores 8-12  $\mu$ .

HAB.: On the ground: Closter, N. J. (*Austin*).

4. **F. hyalinus** WILSON & HOOKER: Jour. Bot. 1841. 89. t. 2.

SULLIVANT: Mosses U. S. 24.—Icon. Musc. 34. t. 21.—LESQ. & JAMES: Man. 84.—MITTEN: Jour. Linn. Soc. 21. 558.

COLL.: SULLIVANT: Musci. All. no. 180.

Plants minute, 2-4 mm. high, pale green, whole plant more or less hyaline, gregarious: stem simple or branched at the base: leaves 3-5 pairs, upper much larger, very thin and soft, oblong-lanceolate, acute, entire, bordered by a single row of very narrow elongate cells; costa none; vaginant lamina less than one-half length; cells large, 32-48 $\times$ 68-100  $\mu$ , thin-walled, elongate-hexagonal, chlorophyll bodies few: flowers dioicous; male unknown; female terminal, two-leaved: fruit terminal; seta 1-2 mm. long; capsule oblong-oval, erect, thin; teeth closely articulate, cleft to middle; operculum rostrate, calyptra covering the beak only; spores 14-20  $\mu$ .

HAB.: Rocky ledges at Bank Lick, near Cincinnati, Ohio (*Lea*, 1839; station lost); on ground in deep ravines near Painesville, Ohio (*Beardslee*).

5. **F. incurvus** SCHWÄGRICHEN: Suppl. I, part 1. t. 49.

BRAITHWAITE: Br. Moss-Fl. 1. 69. t. 10 C.—JAMES: Trans. Am. Phil. Soc. 13. 109.—LESQ. & JAMES: Man. 82.—MITTEN: Jour. Linn. Soc. 21. 557.

COLL.: SULL. & LESQ.: Musci Bor. Am. 2 ed. no. 104.—AUSTIN: Musci App. no. 101, in part.

Plants small, 2-5 mm. high, gregarious or sub cespitose: stem simple, slender, ascending: leaves 4-10 pairs, straight or decurved, not imbricate, oblong-lanceolate to linear-lanceolate, apiculate; border narrow, almost or quite wanting at apex, widening at base; costa percurrent or sub-percurrent; vaginant lamina one-half length or more; inferior lamina narrowed to the base; cells small, 12-14 $\times$ 14-19  $\mu$ , angular-rounded, of the same size but more irregular in vaginant lamina: flowers monoicous; male gemmiform, at the base of stems from which they sometimes separate (pseudo-dioicous): fruit terminal; seta long, red, flexuous; capsule thick, oval, erect, cernuous or arcuate-incurved, pale brown; operculum prominent, conic-rostrate, red; teeth not deeply inserted, very scabrous; calyptra pale; spores 13-17  $\mu$ .

HAB.: On rocks, especially sandstone; not rare in Canada and states east of the Mississippi river; collected also in Texas (*Hall*) and Vancouver Is. (*Macoun*).

Var. **minutulus** AUSTIN: Musci App. n. 102.

*F. minutulus* SULLIVANT: Musci All. no. 183.—Mem. Am. Acad. n. s. 3. 58. t. 2 A.—Mosses U. S. 24.—Icon. Musc. 37. t. 24.—LESQ. & JAMES: Man. 85.—MITTEN: Jour. Linn. Soc. 21. 556.

COLL.: HOOKER & WILSON: Drum. Musci Am. II. nos. 39, 40. (*vide* Sulliv. ms.)—SULLIVANT: Musci All. no. 183.—SULL. & LESQ.: Musci Bor. Am. 1 ed. no. 80 in part.—AUSTIN: Musci App. no. 102.

Plants minute: 1 mm. or less high: leaves narrowly oblong-lanceolate, undulate; some or all narrowly bordered: capsule thin, erect or inclined.

HAB.: On rocks; widely distributed in the Eastern States and Canada; collected also in California (*Mrs. S. R. Mann*).

Var. *exiguus* AUSTIN: Musci App. no. 103.

*F. exiguus* SULLIVANT: Mem. Amer. Acad. n. s. 3. 60. t. 2 B.—Mosses U. S. 24.—Icon. Musc. 36. t. 23.—LESQ. & JAMES: Man. 84.—MITTEN: Jour. Linn. Soc. 21. 557.

COLL.: SULL. & LESQ.; Musci Bor. Am. 1 ed. nos. 79, and 80 in part.—AUSTIN: Musci, App. no. 103.

Plants small: leaves without border except on vaginant lamina: capsule erect or inclined; operculum conic-rostellate.

HAB.: On rocks, Canada, central and eastern States; Colorado (*Bran-degee*).

6. *F. Ravenelii* SULLIVANT: Mem. Amer. Acad. n. s. 4. 171. t. 2.

SULLIVANT: Mosses U. S. 24.—Icon. Musc. 39. t. 25.—LESQ. & JAMES: Man. 85.—MITTEN: Jour. Linn. Soc. 21. 557.

COLL.: SULL. & LESQ. Musci Bor. Am. 1 ed. no. 81.—2 ed. no. 102.—AUSTIN: Musci App. Suppl. no. 481.

Plants minute, 2-4 mm. high, yellowish or dirty-green, gregarious: stem simple: leaves 2-10 pairs,<sup>1</sup> oblong-lanceolate, acute, minutely-denticulate; border none except in the vaginant lamina of the upper leaves of fertile stems where it is broad, prominently and irregularly dentate; costa flexuous, hyaline, percurrent; vaginant lamina one-half length; inferior lamina tapering, reaching the base; cells very small,  $\hat{S}\mu$ , obscure, round quadrate, minutely papillose, each with about two papillæ: flowers dioicous; male plants very small, with 2-3 pairs of leaves; female plants rarely with more than 6 pairs: fruit terminal; seta 4-5 mm. long, yellowish; capsule oval or oblong, when dry urceolate, the cells protuberant; operculum red at base, with a short, inclined beak; spores 10-13  $\mu$ .

HAB.: On damp bricks or on the ground in wet places: Society Hill, N. C. (*Curtis*); Charleston, S. C. (*Ravenel*); Magnolia, Fla. (*J. Donnell Smith*).

7. *F. Garberi* LESQ. & JAMES: Proc. Amer. Acad. 14. 137.

AUSTIN: Bull. Torr. Bot. Club 7. 5.—LESQ. & JAMES: Man. 86.—MITTEN: Jour. Linn. Soc. 21. 558.

Plants minute, 1-3 mm. high, bright green, gregarious: stem simple, rarely dichotomous: leaves 4-8 pairs, sometimes falcate, oblong, obtuse, rarely short-acuminate, the upper four times longer than broad,

<sup>1</sup> SULLIVANT says (Icon. Musc. 39): "7-15 (18-20 in sterile stems)," but does not figure any plants with more than eight. Cf. Icon. Musc. t. 25, Mem. Amer. Acad. n. ser. 4. t.

margin minutely denticulate with doubly papillose cells; border none, except on the lower half of the vaginant lamina of the perichaetial leaves, where it begins abruptly and consists of two or three rows of larger, rectangular-rhomboidal cells; costa flexuous, hyaline, ceasing below apex; vaginant lamina one-half length; inferior lamina tapering to the base; cells small, 6-8  $\mu$ , obscure, round-quadrate to round-hexagonal; flowers terminal, probably dioicous or pseudo-dioicous: fruit terminal; seta equaling or exceeding the stems; capsule erect or sub-erect, elliptical, pale brown, red at the orifice; teeth densely articulate, rufous at base, divisions yellowish; operculum conic-rostrate.

HAB.: On trees, rotten wood, rocks and shells: Florida (*Garber, J. Donnell Smith, Austin*).

**8. *F. Donnellii* AUSTIN:** Bot. Gaz. 4. 151.

LESQ. & JAMES: Man. 85.—MITTEN: Jour. Linn. Soc. 21. 557.

Plants minute, 2-3 mm. high, dark green, gregarious: stem simple: leaves 3 or 4 pairs, the lower oblong-ovate, the upper much elongated, narrowly lanceolate, crenulate-serrate; border none; costa ceasing just below apex; vaginant lamina one-half length; inferior lamina tapering and ceasing before reaching base, or reduced to a mere line; cells small, 12-16  $\mu$ , angular and irregular, each with a single obscure papilla: flowers dioicous, terminal; antheridia 4-6, paraphysate; archegonia unknown: fruit terminal; seta very short; capsule unknown.

HAB.: Base of a cypress tree in a swamp, Caloosa, Fla. (*J. Donnell Smith, Austin*).

**9. *F. obtusifolius* WILSON:** Lond. Jour. Bot. (1845) 4. 196. t. 9.

SULLIVANT: Mosses U. S. 24.—Icon. Musc. 35. t. 22.—LESQ. & JAMES: Man. 86.—MITTEN: Jour. Linn. Soc. 21. 558.

COLL.: SULLIVANT: Musci All. no. 181.—SULL. & LESQ.: Musci Bor. Am. 1 ed. no. 78.—2 ed. no. 99.—AUSTIN: Musci App. Suppl. no. 480.

Plants small, densely gregarious, bright green: stems simple or branched, sometimes with an innovation just below seta, fertile 1-2 mm. high, sterile longer: leaves 4-12 pairs (the fertile stems with rarely more than 6), the lower oval, the upper oval-oblong, obtuse, entire; border none; costa barely reaching the apex, or vanishing below it; vaginant lamina two-thirds length; inferior lamina tapering and ending above base; cells pellucid, round hexagonal, distinct, 10-14  $\mu$ : flowers dioicous, terminal; antheridia 4-6, paraphyses few: fruit terminal; seta light yellow, 2-3 mm. long; capsule thick, oblong, obconic at base; teeth short, orange below, divisions hyaline, granulose; operculum conic, beak very short; spores large, 20-26  $\mu$ .

HAB.: On wet rocks or stones: Holmesburg, Pa. (*James*); Ohio, Cincinnati (*Lea*), Sugar Grove (*Sullivant*), Clifton, Clarke county, (*James*); Canton, Ill. (*Wolf*); Texas (*Hall*).

**10. *F. osmundoides* HEDWIG: Sp: Musc. 153. t. 40.**

BRAITHWAITE: Br. Moss-Fl. 1. 73. t. 11 A.—SULLIVANT: Mosses U. S. 24.—LESQ. & JAMES: Man. 87.—MITTEN: Jour. Linn. Soc. 21. 558.

COLL.: DRUMMOND: Musci Amer. I. no. 112.—SULLIVANT: Musci All. no. 179.—SULL. & LESQ.: Musci Bor. Am. 1 ed. no. 86.—2 ed. no. 109.—AUSTIN: Musci App. no. 104.

Plants of medium size, 1-5 cm. (rarely even 8-10 cm.) high, more or less densely tufted, frequently matted by the brown tomentose rhizoids, olive- or dark-green: stems simple or branched below: leaves numerous, approximate, not imbricated, increasing in size toward the apex of stem, sometimes crisped when dry, oblong-lanceolate, serrulate especially towards the apex; border none; costa vanishing just below the rounded, apiculate apex; vaginant lamina  $\frac{1}{2}$ - $\frac{2}{3}$  length; inferior lamina narrowing slightly toward the base, not decurrent; cells large,  $12-24 \times 16-32 \mu$ , oval-hexagonal: flowers dioicous, terminal: fruit terminal; seta yellowish to dark-red,  $\frac{1}{2}$ -1 cm. long; capsule sub-erect or inclined, light- to red-brown, oblong; the conical operculum with its long, acicular, straight (rarely bent) beak equaling the capsule; calyptra plurilobate at base; spores 20-28  $\mu$ .

HAB.: Common in all situations: Lower Canada, Eastern and Central States; White Fish Bay, Lake Superior (*Gillman*); Grandfather Mt. (*Sullivant*); Rocky Mts. (*Drummond*).

**11. *F. rufulus* BRUCH & SCHIMPER: Bry. Eu. Fiss. Monog. Suppl. II. t. 102.**

SCHIMPER: Syn. Musc. 1 ed. 106.—2 ed. 120.—MILDE: Bry. Siles. 84.—BRAITHWAITE: Br. Moss-Fl. 1. 74. t. 11 B.

*F. ventricosus* LESQUEREUX: Mem. Cal. Acad. 1. 7.—SULLIVANT: Icon. Musc. Suppl. 45. t. 30.—WATSON: Bot. Calif. 2. 374.—LESQ. & JAMES: Man. 84.—MITTEN: Jour. Linn. Soc. 21. 556.

Plants large, robust, 2-5 cm. high, loosely and widely cespitose, blackish below, the young branches dark green: stem erect, branching dichotomously at the base, the branches simple or sparingly divided, with rhizoids among the leaves: leaves numerous, crowded, somewhat imbricate, cultriform or scalpelliform, entire; border thick, reddish, ceasing just below the apex; costa strong, percurrent; vaginant lamina  $\frac{1}{2}$ - $\frac{2}{3}$  length, ventricose, margin flexuous near apex; inferior lamina tapering regularly to the base; cells thick-walled, polygonal,  $8-12 \times 8-16 \mu$ : flowers dioicous, terminal; male plants shorter: fruit terminal; seta short, scarcely exceeding the leaves, thick; capsule thick, erect, elliptical, pale below, reddish above; teeth erect, coarsely articulated, upper portions spirally thickened; operculum short-conic; calyptra cucullate; spores oval, large, 24-32  $\mu$ .

HAB.: On submerged rocks in streams: Mendocino City, Cal. (*Bolander*); Silver Creek, Oregon (*Hall*).